REMARKS

I. Rejection of claims 1-8 under 35 U.S.C. §103(a)

1. The Rejection

Claim 1-8 are rejected under 35 U.S.C. §103(a) as being unpatentable over Sakuma et al (US 6,377,331) in view of Hammond et al. Specifically, Sakuma is cited for disclosing an optical member for photolithography comprising a calcium fluoride crystal exhibiting an internal transmittance of 88.5% or greater with respect to light emitted from an F_2 (157 nm) laser. The difference [between Sakuma and the claimed invention] is Sakuma '32 does not disclose the chlorine concentration in the fluoride crystal.

Hammond '245 is cited as disclosing a highly purified crystal of an alkali halide material useful as an optical element. Hammond '245:

> ". . .disclosed that graphite has been used as a crucible material for growing calcium fluoride and barium fluoride [crystals]. It has the desirable properties of being very resistant to corrosion by these inorganic crystal materials, and resulting in little contamination. Unfortunately however, graphite is porous. When it is used as a crucible material for alkali metal halide growth, the melt leaks into and through the crucible, thus making such crucible unsuitable for alkali metal halide crystal growth. In addition, surface of the graphite upon cooling [*missing language?*], thereby preventing their ready removal from the crucible without damage to either the boule or the crucible ...
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> "Sakuma '332 discloses a crucible comprising a vessel of porous carbon having a wall with a thickness, an outer surface, and an inner surface; a surface depth region of at least the inner surface being impregnated with additional carbon to close open porosity at the surface (see claim 1), The porous carbon can be graphite(note claim 2) and the addition carbon can be graphitic pyrolytic carbon (note claim 3) or glassy carbon (note claim 4). The crucible can be used for growing calcium fluoride (note column 6, lines 28-32).
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> "Thus it would have been obvious to one of ordinary skill in the art at the time the invention was made to maximize the purity of the calcium fluoride disclosed in Sakuma '332 as suggested by Hammond '245. Also, it would have been obvious to one skilled in the art to use the crucible of Hammond '245 in the process of producing the calcium fluoride of Sakuma '332 because such crucible would permit release of the cooled crystal without remelting (note abstract), since graphite was not in contact with the crystal, any chloride impurity in the graphite would not migrate to the crystal itself."

Applicants traverse the rejection of claims 1-8

2. Applicants Response to the Rejection

Applicants' invention is directed to the reduction of scatter in CaF_2 crystals. Specifically, it is directed to the reduction of scatter by reducing the chloride level in CaF_2 to less than 0.25 ppm. The reduction of scatter is not mentioned in either the Sakuma or the Hammond citation. Further, in neither citation do the inventors provide any analysis of the chloride level present in the CaF_2 crystals they grow. As a result, distinguishing applicants' claimed over the cited art must rely on reasonable arguments.

First, a literature search conducted after receiving the present Office Action resulted locating an article by W. Bardsley and G.W. Green, "Optical scattering in calcium fluoride crystals", Brit J. Appl. Phys., 1965, Vol. 16, pages 911-912 [copy enclosed]. In this article the authors state that while is it generally believed that scatter in CaF_2 crystal is caused by calcium oxide, they present evidence that shown that chlorine and sulfur can also cause scatter. This article supports applicants' position that the present of chloride and/or sulfur in CaF_2 crystals induces scatter. The articles indicate that chlorine and sulfur levels should be below 50 ppm and 20 ppm, respectively; though how much below is not specified. However, since in 1965, the time the articles was written, high power excimer lasers operating below 200 nm were unknown (excimer laser were not invented until about 1971) it is unlikely that the effect of very small amounts of chlorine and sulfur in CaF_2 optics were considered. The He/Ne was the only gas laser truly known at this time, the CO_2 and Ar lasers not being invented until about 1964. Thus the Bardsley/Green articles does not provide any guidance regarding the level to which chloride and/or sulfur should be reduced in order to prevent scatter in CaF_2 crystals that are used for lasers operating below 200 nm and particularly for F_2 lasers that operate at 157 nm. There is certainly no teaching or suggestion that the chloride levels should be reduces to sub-ppm levels as is taught by the present invention.

Second, the cited Sakuma patent is completely silent as has been acknowledged by the Examiner, with regard to the fluoride content of the CaF_2 crystal. Applicants have searched the PTO Patent Base for other Sakuma patent using the terms "IN/Sakuma and AN/Nikon", and have reviewed each of the patent found. Applicants have also reviewed patent issued to Sakuma's co-workers at Nikon (Shiozawa, Mizugaki, Kimura and Takano) and reviewed the patents found in these searches. None of these patents mention ***chloride*** contaminant levels in CaF_2 optics. The only mention of contaminants found in the patents located in the foregoing searches concerning CaF_2 manufacture are the levels of sodium and potassium

(Shiozawa, US 6,320,700, 6,226,128 and 6,061,174). Consequently, applicants are led to believe that Sakuma and co-workers did not consider chloride levels to be a source of problems for CaF_2 crystals. This is fortified by the fact that the carbon ingot manufacturers (the ingots are used for making the crucibles used in CaF_2 crucibles) mention only metallic impurities and not non-metallic impurities. As a result of these patent reviewed, applicants reasonable believe that Sakuma and co-workers did not realize that chloride levels CaF_2 was a source of scatter.

Third, the Hammond patent is cited for teaching that one can apply a pyrolytic or glassy carbon coating to a crucible to close the pores of the crucible. Hammond used this technique to prevent molten alkali metal fluoride from seeping through the crucibles. Hammond made no mention either using the technique for molten alkaline metal fluorides or whether it was even necessary. Since none of the Sakuma and other Nikon assigned patent reviewed mentions the use of such crucibles, not do applicants, applicants submit that the Hammond technique is unnecessary. Hence, there is no teaching applicable to the present invention.

However, for arguments' sake and completeness only, we will assume that sealing the pores of a graphite crucible is desirous to prevent leakage of a molten alkaline earth metal fluoride. Using the Hammond technique one first purifies the crucible by using a high temperature chlorine technique ('245 patent, column 3, lines 37-39). Subsequently, one applies the pyrolytic or glass carbon coating by decomposition of an organic vapor such as an ether or an alcohol. Hammond states that carbon from the decomposition fills the pores of the graphite crucible. However, during this process the chlorine present in the crucible, which is increased as a result of the chlorine purification step, can migrate into the later of pyrolytic or glassy carbon that is being deposited. While the resulting coating may be "smooth", it may also contain a high level of chlorine that would contaminate a CaF_2 crystal and increase scatter in the below 200 nm region. Hammond does not mention what is the level of chlorine (or chloride) in either the coated crucible or his alkali metal fluoride products.

Therefore, in view of the fact that both Sakuma and Hammond are silent on the chloride levels in their products, and in further view of the fact that Hammond teaches a chlorine purification step for purifying a graphite crucible, applicants submit that the combination of Sakuma and Hammond do not teach or suggest the claimed invention. As a

result, applicants respectfully submit that it is proper for the Examiner to withdraw the rejection of claims 1-8 over Sakuma in view of Hammond.

II. Conclusion

Based upon the above amendments, remarks, and papers of record, applicants believe the pending claims of the above-captioned application are in allowable form and patentable over the prior art of record. Applicants respectfully request reconsideration of the pending claims, 1-8 and a prompt Notice of Allowance thereon.

Applicants believe that no extension of time is necessary to make this Response timely. Should Applicants be in error, Applicants respectfully request the Office grant such time extension pursuant to 37 C.F.R. § 1.136(a) as necessary to make this Response timely, and hereby authorizes the Office to charge any necessary fee or surcharge with respect to said time extension to the deposit account of the undersigned firm of attorneys, Deposit Account 03-3325.

Please direct any questions or comments to Walter M. Douglas at (607) 974-2431.

25 July 2005
Date

CERTIFICATE OF TRANSMISSION UNDER 37 C.F.R. § 1.8

I hereby certify that this paper and any papers referred to herein are being transmitted by facsimile to the U.S. Patent and Trademark Office at 703-872-9306 on 25 July 2005
Date

Walter M. Douglas 25 July 2005
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Respectfully submitted,
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